

High End Computing and Computation Working Group

HECC Strategic Plan Overview

Information for **Presidential Advisory Committee**

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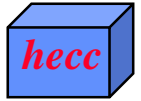
Vision and Strategy

- **Vision**

- Maintain U.S. leadership in high-end computing (HEC)
- Promote effective use of HEC for government, industry, academic and broad societal applications

- **Strategy**

- Community-developed HECC R&D agenda
- Agency programs coordinated through CIC R&D process
- Support spectrum of activities from research to mission-driven
- Promote jointly-funded/managed projects
- Sustain on-going agency investments, especially in Applications and Infrastructure, and pursue new augmentations in high priority areas
- Assign lead roles to agencies for specific focused HECC efforts as in NGI



Nation Needs High End Computing

- Maintain U.S. leadership in high end computing (HEC)
- Support critical federal government mission needs
 - national security
 - weather modeling, disaster warning & relief
 - aeronautics and space exploration
 - energy research
 - basic science and engineering
- Promote insertion of HEC in U.S. industry sector for U.S. competitiveness
- Promote broad societal applications
 - healthcare
 - education and lifelong learning
 - long-term environment and energy management
 - human services
 - crisis management

HECC Thrusts

1. System software technology

Major improvements in usability and effectiveness of TeraFLOPS-scale systems across a wide range of government, industry and academic applications

2. Leading-edge research for future-generations computing

Research and technology necessary for PetaFLOPS-level computation & exabyte-level mass storage.

3. Incorporation of technology into real applications

First use of HECC technologies into agency applications, the practice of high-performance computational science and the required underlying algorithms

4. Infrastructure for research in HECC

Research computational facilities, large-scale test systems and high-performance networks to maintain a state-of-the-art infrastructure for HECC.

Thrust 1: System Software Technology for High-End Computing

Goal: Achieve major improvements in usability and effectiveness of TeraFLOPS-scale systems across a wide range of government, industry and academic applications

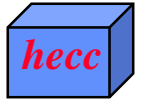
Medium range technology development (< 3-5 years)

Develop tools and system software for use on distributed, and heterogeneous high-end systems which improve:

scalability throughput speedup portability programmability

R&D investment focus:

- Languages and compilers
- Debugging and performance tools
- Programming interfaces and libraries
- Operating systems and I/O
- Common framework and infrastructure



Thrust 2: Leading-edge research for future-generations computing

Goal: Support research and technology necessary for PetaFLOPS-level computation and exabyte-level mass storage.

Long range research (> 5 years)

R&D investment focus:

- Innovative technology
 - Software
 - Hardware including device components
 - Models of computation
- Systems and Architecture
- Laboratory demonstration prototypes

Thrust 3: Technology into real applications

Goal: Incorporate first use of HECC technologies into agency applications, develop the practice of high-performance computational science and the required underlying algorithms, to ensure that key applications will be able to run at full potential.

R&D Investment focus:

- HECC Applications (current)
 - Grand Challenge Teams (DOE, NASA, NSF, NOAA, EPA)
 - Scientific visualization and data management
 - Cross-cutting technologies
- Computational Science (near-term 1-3 years)
 - Develop as third methodology and integrate to mutually complement theory and experiment
- Algorithm Improvement (3-5 years)
 - Application parallelism and latency

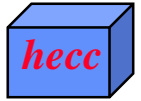
Thrust 4: Infrastructure for research in HECC

Goal: Ensure that the full potential of research computational facilities, large-scale test systems and high-performance networks are realized by planning and coordinating the design, implementation and maintenance of a state-of-the-art infrastructure for HECC. Through coordination and an active information exchange, ensure a balanced infrastructure with maximum computational strength and bandwidth.

Support **current** research agenda with research facilities built on large-scale test systems and, on large-scale, high-performance networks

R&D Investment focus:

- Research Facilities
- Access to large-scale test systems
- Build on large-scale high performance networks



HECC Major Accomplishments

- Established scalable parallel processing as the commercial standard for high performance computing
- Enabled the technology base for the \$2 billion middle range high performance market which expanded access to high performance computing, while reducing costs to the government
- Invented and proved massively parallel systems as effective high-end computing devices
- Enabled the near-term computing technology for DOE's ASCI program
- Created the scientific base for High End Computing, including trained scientists and engineers, new architectural approaches and next-generation technologies

Questions for Presidential Advisory Committee

- What role should the federal government play in high-end computing and computation?
- What steps should the federal government take to best work with industry and academia toward providing for these national needs?